

Titan's Surface Brightness Temperatures and H₂ Mole Fraction from Cassini CIRS

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The atmosphere of Titan has a spectral window of low opacity around 530 cm⁻¹ in the thermal infrared where radiation from the surface can be detected from space. The Composite Infrared Spectrometer¹ (CIRS) uses this window to measure the surface brightness temperature of Titan. By combining all observations from the Cassini tour it is possible to go beyond previous Voyager IRIS studies^{2,3} in latitude mapping of surface temperature. CIRS finds an average equatorial surface brightness temperature of 93.7±0.6 K, which is close to the 93.65±0.25 K value measured at the surface by Huygens HASI⁴. The temperature decreases toward the poles, reaching 91.6±0.7 K at 90 S and 90.0±1.0 K at 87 N. The temperature distribution is centered in latitude at approximately 12 S, consistent with Titan's season of late northern winter. Near the equator the temperature varies with longitude and is higher in the trailing hemisphere, where the lower albedo may lead to relatively greater surface heating⁵. Modeling of radiances at 590 cm⁻¹ constrains the atmospheric H₂ mole fraction to 0.12±0.06 %, in agreement with results from Voyager IRIS⁶.

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